TABLE 9—CONVEYANCE ACTIVITY LIMITS FOR LSA MATERIAL AND SCO

Nature of material	Activity limit for conveyances
LSA–I	No limit.
LSA–II and LSA–III; noncombustible solids.	No limit.
LSA–II and LSA–III; Combustible solids and all liquids and gases.	100 A_2
SCO	100 A_2

[Amdt. 173–244, 60 FR 50307, Sept. 28, 1995, as amended by Amdt. 173–244, 61 FR 20752, May 8, 1996; 63 FR 52849, Oct. 1, 1998]

§ 173.428 Empty Class 7 (radioactive) materials packaging.

A packaging which previously contained Class 7 (radioactive) materials and has been emptied of contents as far as practical, is excepted from the shipping paper, certification, and marking requirements of this subchapter, and from requirements of this chapter, provided that—

(a) The packaging meets the requirements of §173.421(a) (2), (3), and (5) of this subpart;

(b) The packaging is in unimpaired condition and is securely closed so that there will be no leakage of Class 7 (radioactive) material under conditions normally incident to transportation;

(c) Internal contamination does not exceed 100 times the limits in §173.443(a);

(d) Any labels previously applied in conformance with subpart E of part 172 of this subchapter are removed, obliterated, or covered and the ''Empty'' label prescribed in §172.450 of this subchapter is affixed to the packaging; and

(e) The packaging is prepared for shipment as specified in §173.422.

[Amdt. 173–244, 60 FR 50307, Sept. 28, 1995, as amended by Amdt. 173–244, 61 FR 20752, May 8, 1996; 64 FR 51919, Sept. 27, 1999]

§ 173.431 Activity limits for Type A and Type B packages.

(a) Except for LSA material and SCO, a Type A package may not contain a quantity of Class 7 (radioactive) materials greater than A_1 for special form Class 7 (radioactive) material or A_2 for normal form Class 7 (radioactive) material as listed in §173.435, or, for Class 7 (radioactive) materials not listed in §173.435, as determined in accordance with §173.433.

(b) The limits on activity contained in a Type B, Type B(U), or Type B(M) package are those prescribed in §§173.416 and 173.417, or in the applicable approval certificate under §§173.471, 173.472 or 173.473.

§ 173.433 Requirements for determining A_1 and A_2 values for radionuclides and for the listing of radionuclides on shipping papers and labels.

(a) Values of A_1 and A_2 for individual radionuclides that are the basis for many activity limits elsewhere in this subchapter are given in the table in §173.435.

(b) For individual radionuclides whose identities are known, but which are not listed in the table in §173.435, the determination of the values of A^1 and A_2 requires approval from the Associate Administrator for Hazardous Materials Safety except that the values of A_1 and A_2 in table 10 may be used without obtaining approval from Associate Administrator for Hazardous Materials Safety.

(c) In calculating A_1 and A_2 values for a radionuclide not listed in the table in §173.435, a single radioactive decay chain in which the radionuclides are present in their naturally-occurring proportions, and in which no daughter nuclide has a half life either longer than 10 days or longer than that of the parent nuclide, will be considered as a single radionuclide, and the activity to be taken into account and the A_1 or A_2 value to be applied will be those corresponding to the parent nuclide of that chain. Otherwise, the parent and daughter nuclides will be considered as a mixture of different nuclides.

(d) Mixtures of radionuclides whose identities and respective activities are known, must conform to the following conditions:

(1) For special form Class 7 (radioactive) material:

$$\sum_i \frac{B(i)}{A_1(i)} \quad \text{less than or equal to 1}$$

Where B(i) is the activity of radionuclide i and $A_1(i)$ is the A_1 value for radionuclide i;

or

(2) For other forms of Class 7 (radioactive) material, either—

$$\sum_i \frac{B(i)}{A_2(i)} \quad \text{less than or equal to 1}$$

Where B(i) is the activity of radionuclide i and $A_2(i)$ is the A_2 value for radionuclide i;

or

$$A_2 \text{ for mixture} = \frac{1}{\sum_i \frac{f(i)}{A_2(i)}}$$

where f(i) is the fraction of activity of nuclide i in the mixture and $A_2(i)$ is the appropriate A_2 value for nuclide i.

(e) When the identity of each nuclide is known but the individual activities of some of the radionuclides are not known, the radionuclides may be grouped and the lowest A_1 or A_2 value, as appropriate, for the radionuclides in each group may be used in applying the formulas in paragraph (d) of this section. Groups may be based on the total alpha activity and the total beta/gamma activity when these are known, using the lowest A_1 or A_2 values for the alpha emitters or beta/gamma emitters, respectively.

(f) *Shipping papers and labeling.* (1) For mixtures of radionuclides, the radionuclides (n) that must be shown on shipping papers and labels in accordance with §§ 172.203 and 172.403 of this subchapter, respectively, must be determined on the basis of the following formula:

$$\sum_{i=1}^{n} \frac{a_{(i)}}{A_{(i)}} \geq 0.95 \sum_{i=1}^{n+m} \frac{a_{(i)}}{A_{(i)}}$$

Where n + m represents all the radionuclides in the mixture, m are the radionuclides that do not need to be considered, a_i is the activity of radionuclide i in the mixture, and A_i is the A_1 or A_2 value, as appropriate for radionuclide i.

(g) Table 10 is as follows:

TABLE 10—GENERAL VALUES FOR A_1 AND A_2

Contents	A_1		A_2	
	(TBq)	(Ci)	(TBq)	(Ci)
Only beta or gamma emitting nuclides are known to be present	0.2	5	0.02	0.5
Alpha emitting nuclides are known to be present or no relevant data are available	0.10	2.70	2×10^{-5}	5.41×10^{-4}

[Amdt. 173–244, 60 FR 50307, Sept. 28, 1995, as amended at 63 FR 52849, Oct. 1, 1998]

§ 173.434 Activity-mass relationships for uranium and natural thorium.

The table of activity-mass relationships for uranium and natural thorium are as follows:

Thorium and uranium enrichment[1](Wt% ^{235}U present)	Specific activity			
	TBq/gram	Grams/Tbq	Ci/gram	Grams/Ci
0.45 (depleted)	1.9×10^{-8}	5.4×10^{7}	5.0×10^{-7}	2.0×10^{6}
0.72 (natural)	2.6×10^{-8}	3.8×10^{7}	7.1×10^{-7}	1.4×10^{6}
1.0	2.8×10^{-8}	3.6×10^{7}	7.6×10^{-7}	1.3×10^{6}
1.5	3.7×10^{-8}	2.7×10^{7}	1.0×10^{-6}	1.0×10^{6}
5.0	1.0×10^{-7}	1.0×10^{7}	2.7×10^{-6}	3.7×10^{5}
10.0	1.8×10^{-7}	5.6×10^{6}	4.8×10^{-6}	2.1×10^{5}
20.0	3.7×10^{-7}	2.7×10^{6}	1.0×10^{-5}	1.0×10^{5}
35.0	7.4×10^{-7}	1.4×10^{6}	2.0×10^{-5}	5.0×10^{4}
50.0	9.3×10^{-7}	1.1×10^{6}	2.5×10^{-5}	4.0×10^{4}
90.0	2.1×10^{-6}	4.7×10^{5}	5.8×10^{-5}	1.7×10^{4}
93.0	2.6×10^{-6}	3.9×10^{5}	7.0×10^{-5}	1.4×10^{4}
95.0	3.4×10^{-6}	3.0×10^{5}	9.1×10^{-5}	1.1×10^{4}
Natural thorium	8.1×10^{-9}	1.2×10^{8}	2.2×10^{-7}	4.6×10^{6}

[1] The figures for uranium include representative values for the activity of uranium-234 which is concentrated during the enrichment process. The activity for thorium includes the equilibrium concentration of thorium-228.